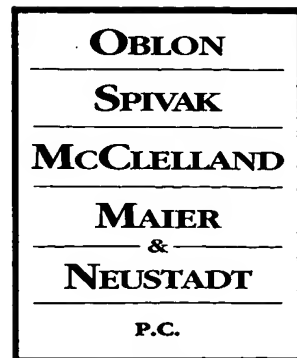




Docket No.: 240093US2DIV  
Date Allowed: 06/08/04

COMMISSIONER FOR PATENTS  
ALEXANDRIA, VIRGINIA 22313



ATTORNEYS AT LAW

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RE: Application Serial No.: 10/617,769  
Applicants: Tsuneo KUROTORI, et al.  
Filing Date: July 14, 2003  
For: LIQUID IMAGE FORMATION APPARATUS AND  
LIQUID DEVELOPING DEVICE  
Group Art Unit: 2852  
Examiner: Chen, S.S.

SIR:

Attached hereto for filing are the following papers:

**PETITION UNDER 37 CFR §1.181(a)(3)**  
**COPY OF IDS FILED 07/14/03, COPY OF DATE-STAMPED FILING RECEIPT**  
**COPY OF MACHINED TRANSLATED "AQ"JP7-21935 REFERENCE**

Our check in the amount of -0- is attached covering any required fees. In the event any variance exists between the amount enclosed and the Patent Office charges for filing the above-noted documents, including any fees required under 37 C.F.R. 1.136 for any necessary Extension of Time to make the filing of the attached documents timely, please charge or credit the difference to our Deposit Account No. 15-0030. Further, if these papers are not considered timely filed, then a petition is hereby made under 37 C.F.R. 1.136 for the necessary extension of time. A duplicate copy of this sheet is enclosed.

Respectfully submitted,

OBLON, SPIVAK, McCLELLAND,  
MAIER & NEUSTADT, P.C.

  
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DOCUMENT NO. 240093US2DIV

IN THE UNITED STATES PATENT & TRADEMARK OFFICE

IN RE APPLICATION OF : DATE ALLOWED: 06/08/04  
TSUNEO KUROTORI, ET AL. : EXAMINER: CHEN, S. S.  
SERIAL NO: 10/617,769 :  
FILED: JULY 14, 2003 : GROUP ART UNIT: 2852  
FOR: LIQUID IMAGE FORMATION :  
APPARATUS AND LIQUID  
DEVELOPING DEVICE

PETITION UNDER 37 CFR §1.181(a)(3)

COMMISSIONER FOR PATENTS  
ALEXANDRIA, VIRGINIA 22313

SIR:

This is a Petition pursuant to 37 CFR §1.181(a)(3) requesting that the examiner be provided the application file in order for the examiner to properly acknowledge consideration of all of the references cited during the prosecution of the parent application (Serial No. 10/050,959).

STATEMENT OF FACTS

On July 14, 2003, Information Disclosure Statement (IDS) papers were filed that included a copy of a Form PTO-1449 listing references cited during the prosecution of the above-noted parent application (Serial No. 10/050,959), as documented by the attached copy of these IDS papers including copies of the Form PTO-1449 and the associated date-stamped mail room filing receipt.

Upon review of this Application after the allowance thereof, it was noted that reference "AQ" (JP 7-21935) was the only cited reference lined out on the copy of the Form PTO-1449 provided with the Action mailed February 25, 2004, with no explanation being

Application No. 10/617,769

Reply to the Notice of Allowance Mailed 06/08/04

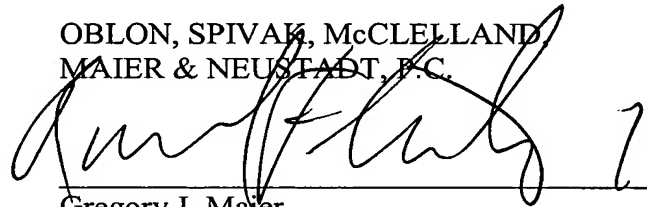
given as to this failure to acknowledge consideration of this reference cited in the parent application.

ACTION REQUESTED

It is respectfully requested that the Examiner be supplied with the application file so that she can satisfy the requirements of MPEP §609(I)(A)(2) as to considering all information which has been considered in the parent application and making this information of record so that it is printed on the patent. In order to expedite this required consideration, a machine translated copy of listing "AQ" (JP 7-21935) is provided herewith along with the above-noted IDS papers.

RESPECTFULLY SUBMITTED,

OBLON, SPIVAK, McCLELLAND,  
MAIER & NEUSTADT, P.C.

A handwritten signature in black ink, appearing to read 'Gregory J. Maier', is written over a horizontal line.

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(OSMMN 06/04)

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E

Dept.: E/M

By: GJM/RFC/jmp

OSMM&N File No. 240093US2DIV

Serial No. NEW DIV. APPLICATION

In the matter of the Application of: Tsuneo KUROTORI, et al.

For: LIQUID IMAGE FORMATION APPARATUS AND LIQUID DEVELOPING  
DEVICE

Due Date: 07/14/03

The following has been received in the U.S. Patent Office on the date stamped hereon:

- ☒ 154 pp. Specification 83 Claims/Drawings 23 Sheets and  
☒ 3 Pages Application Data Sheet
- ☒ Combined Declaration, Petition & Power of Attorney 4 Pages (Copy)
- ☒ Utility Patent Application Transmittal
- ☒ Check for \$750.00 ☐ Dep. Acct. Order Form
- ☒ Fee Transmittal Form
- ☒ Preliminary Amendment
- ☒ Information Disclosure Statement ☒ PTO-1449
- ☐ White Advance Serial Number Card
- ☒ Request for Priority



Docket No. 240093US-2 DIV



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

IN RE APPLICATION OF: TSUNEO KUROTORI, ET AL.

SERIAL NO: NEW DIV. APPLICATION

GAU:

FILED: HEREWITH

EXAMINER:

FOR: LIQUID IMAGE FORMATION APPARATUS AND LIQUID DEVELOPING DEVICE

**INFORMATION DISCLOSURE/RELATED CASE STATEMENT UNDER 37 CFR 1.97**

COMMISSIONER FOR PATENTS  
ALEXANDRIA, VIRGINIA 22313

SIR:

Applicant(s) wish to disclose the following information.

**REFERENCES**

- ☒ The applicant(s) wish to make of record the references listed on the attached form PTO-1449 which were submitted in Application Serial No. 10/050,959 filed 01/22/02 and which were cited in PTO-892, where required, as are either statements of relevancy or any readily available English translations of pertinent portions of any non-English language references.
- ☐ A check is attached in the amount required under 37 CFR §1.17(p).

**RELATED CASES**

- ☐ Attached is a list of applicant's pending application(s) or issued patent(s) which may be related to the present application. A copy of the patent(s), together with a copy of the claims and drawings of the pending application(s) is attached along with PTO 1449.
- ☐ A check is attached in the amount required under 37 CFR §1.17(p).

**CERTIFICATION**

- ☐ Each item of information contained in this information disclosure statement was first cited in a communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of this statement.
- ☐ No item of information contained in this information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application or, to the knowledge of the undersigned, having made reasonable inquiry, was known to any individual designated in 37 CFR §1.56(c) more than three months prior to the filing of this statement.

**DEPOSIT ACCOUNT**

- ☒ Please charge any additional fees for the papers being filed herewith and for which no check is enclosed herewith, or credit any overpayment to deposit account number 15-0030. A duplicate copy of this sheet is enclosed.

Respectfully submitted,

OBLON, SPIVAK, McCLELLAND,  
MAIER & NEUSTADT, P.C.



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Gregory J. Maier  
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Attorney of Record  
Raymond F. Cardillo, Jr.  
Registration No. 40,440

Form PTO 1449  
(Modified)U.S. DEPARTMENT OF COMMERCE  
PATENT AND TRADEMARK OFFICEATTY DOCKET NO.  
240093US-2 DIV

SERIAL NO.

LIST OF REFERENCES CITED BY APPLICANT

APPLICANT

TSUNEO KUROTORI, ET AL.

FILING DATE  
HEREWITH

GROUP

## U.S. PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUB CLASS	FILING DATE IF APPROPRIATE
	AA	4,052,959	10/1977	Hayashi et al.			
	AB	5,359,398	10/1994	Echigo et al			
	AC	5,374,980	12/1994	Kubo et al.			
	AD	6,219,500	04/2001	Byun, S.			
	AE	6,370,347	04/2002	Shin et al.			
	AF						
	AG						
	AH						
	AI						
	AJ						
	AK						
	AL						
	AM						
	AN						

## FOREIGN PATENT DOCUMENTS

		DOCUMENT NUMBER	DATE	COUNTRY	TRANSLATION YES NO	
	AO	7-209922	08/11/95	Japan (with English Abstract)		x
	AP	7-152254	06/16/95	Japan (with English Abstract)		x
	AQ	7-21935	01/24/95	Japan (with English Abstract)		x
	AR	2000-47490	02/18/00	Japan (with English Abstract)		x
	AS	2000-242088	09/08/00	Japan (with English Abstract)		x
	AT	2001-228717	08/24/01	Japan (with English Abstract)		x
	AU	01-206379	08/1989	Japan		
	AV					

## OTHER REFERENCES (Including Author, Title, Date, Pertinent Pages, etc.)

	AW	
	AX	
	AY	
	AZ	

Examiner

Date Considered

\*Examiner: Initial if reference is considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

## PATENT ABSTRACTS OF JAPAN

(11)Publication number : 07-021935

(43)Date of publication of application : 24.01.1995

(51)Int.Cl.

H01J 29/50

(21)Application number : 05-161897

(71)Applicant : HITACHI LTD

(22)Date of filing : 30.06.1993

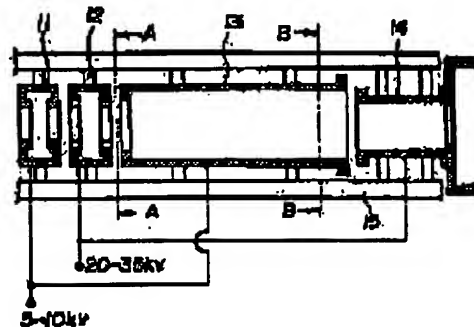
(72)Inventor : WATANABE KENICHI  
SHIRAI MASAJI

### (54) CATHODE-RAY TUBE

#### (57)Abstract:

**PURPOSE:** To simplify electron gun structure without reducing a lens electrode aperture of a main lens body and to enhance focusing performance by forming the electrode structure of the main lens body in a facing type and by installing a flattened electrode means.

**CONSTITUTION:** A front lens portion of a main lens body consists of a third grid electrode 11, a fourth grid electrode 12, and a fifth grid electrode 13. Focus voltage of 5-10kV (low voltage) is applied to the electrode 11 and the electrode 13, and high voltage of 20-35kV is applied to the electrode 12 and an electrode 14. The electrode 13 and the electrode 14 have a flat cross section in a horizontal direction. Since the flat ratio of the electrode 14 is larger than that of the electrode 13, astigmatism is corrected and the unbalance of a spherical aberration is corrected, and a circular electron beam spot is displayed on a fluorescent screen. Electron gun structure is simplified without reducing a lens aperture of the main lens body, and focusing performance is enhanced.



#### LEGAL STATUS

[Date of request for examination] 28.06.2000

[Date of sending the examiner's decision of rejection] 02.03.2004

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's

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No. 8788 P. 4  
2/2 ページ

decision of rejection]

[Date of extinction of right]

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2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

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**CLAIMS**

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**[Claim(s)]**

**[Claim 1]** In the cathode-ray tube equipped with the electron beam generating section which is arranged on a common flat surface and generates two or more controlled electron beams, and the main lens section which completes two or more electron beams generated from said electron beam generating section on a phosphor screen at least The electrode of a couple is included at least. said main lens section counters the travelling direction of an electron beam with fixed spacing mutually, and a cross section is flat in a direction parallel to said common flat surface — at the time of actuation of a cathode-ray tube Impress a low battery to one side of the electrode of said couple, and it comes to impress high tension by another side. It has the flattening electrode means which consists of at least one electrode with which said main lens section fabricates flatly the cross-section configuration of said electron beam which carries out incidence to the electrode of said couple in said direction of a common flat surface. The cathode-ray tube to which it comes to impress said low battery by at least one electrode which constitutes said flattening electrode means, and the operation which fabricates the cross-section configuration of said electron beam flatly is characterized by providing the electron gun constituted so that it might decrease with lifting of said low battery with said flattening electrode means.

**[Claim 2]** In the cathode-ray tube equipped with the electron beam generating section which is arranged on a common flat surface and generates two or more controlled electron beams, and the main lens section which completes two or more electron beams generated from said electron beam generating section on a phosphor screen at least The electrode of a couple is included at least. said main lens section counters the travelling direction of an electron beam with fixed spacing mutually, and a cross section is flat in a direction parallel to said common flat surface — at the time of actuation of a cathode-ray tube The flat degree of the cross section of the electrode of said another side which impresses a low battery to one side of the electrode of said couple, and impresses high tension to another side, and impresses said high tension comes to constitute more greatly than whenever [ of the cross section of one / said / electrode / flat ]. It has the flattening electrode means which consists of at least one electrode with which said main lens section fabricates flatly the cross-section configuration of said electron beam which carries out incidence to the electrode of said couple in said direction of a common flat surface. The cathode-ray tube to which it comes to impress said low battery by at least one electrode which constitutes said flattening electrode means, and the operation which fabricates the cross-section configuration of said electron beam flatly is characterized by providing the electron gun constituted so that it might decrease with lifting of said low battery with said flattening electrode means.

**[Claim 3]** In the cathode-ray tube equipped with the electron beam generating section which generates the controlled single electron beam, and the main lens section which completes the electron beam generated from said electron beam generating section on a phosphor screen at least The electrode of a couple is included at least. said main lens section counters the travelling direction of an electron beam with fixed spacing mutually, and a cross section is flat in one direction — at the time of actuation of a cathode-ray tube Impress a low battery to one side of

the electrode of said couple, and it comes to impress high tension by another side. It has the flattening electrode means which consists of at least one electrode with which said main lens section fabricates flatly the cross-section configuration of said electron beam which carries out incidence to the electrode of said couple in said one direction. The cathode-ray tube to which it comes to impress said low battery by at least one electrode which constitutes said flattening electrode means, and the operation which fabricates the cross-section configuration of said electron beam flatly is characterized by providing the electron gun constituted so that it might decrease with lifting of said low battery with said flattening electrode means.

[Claim 4] In the cathode-ray tube equipped with the electron beam generating section which generates the controlled single electron beam, and the main lens section which completes the electron beam generated from said electron beam generating section on a phosphor screen at least The electrode of a couple is included at least. said main lens section counters the travelling direction of an electron beam with fixed spacing mutually, and a cross-section configuration is flat in one direction — at the time of actuation of a cathode-ray tube The flat degree of the cross section of the electrode of said another side which impresses a low battery to one side of the electrode of said couple, and impresses high tension to another side, and impresses said high tension comes to constitute more greatly than whenever [ of the cross section of one / said / electrode / flat ]. It has the flattening electrode means which consists of at least one electrode with which said main lens section fabricates flatly the cross-section configuration of said electron beam which carries out incidence to the electrode of said couple in said one direction. The cathode-ray tube to which it comes to impress said low battery by at least one electrode which constitutes said flattening electrode means, and the operation which fabricates the cross-section configuration of said electron beam flatly is characterized by providing the electron gun constituted so that it might decrease with lifting of said low battery with said flattening electrode means.

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[Translation done.]

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2. \*\*\*\* shows the word which can not be translated.

3. In the drawings, any words are not translated.

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**DETAILED DESCRIPTION**

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**[Detailed Description of the Invention]****[0001]**

**[Industrial Application]** This invention relates to the cathode-ray tube equipped with the electron gun which has the main lens which was applied to the cathode-ray tube used for a direct viewing type or a projection mold television receiver, terminal display equipment, etc., especially reduced aberration, and raised resolution.

**[0002]**

**[Description of the Prior Art]** It consists of the funnel sections the panel section whose cathode-ray tube to be used is an image screen, the neck section which holds an electron gun, and the panel section and the neck section are connected [ funnels / colour picture displays /, such as a direct viewing type or a projection mold television receiver, and terminal display equipment, ], and said funnel section is equipped with the deflecting yoke which makes the electron beam discharged from an electron gun scan on the phosphor screen formed in the inner surface of the panel section.

**[0003]** The electron gun held in said neck section is equipped with the main lens section which turns into the electron beam generating section with the cathode electrode which generates an electron beam, and the control electrode which controls an electron beam from the various electrodes for converging, accelerating the controlled electron beam and concentrating. It becomes irregular with the signal impressed to a control electrode. subsequently the electron beam discharged from the cathode electrode gives a cross-section configuration and energy necessary with the main lens electrode, and it points to it on a phosphor screen.

**[0004]** Drawing 9 is a cross section explaining the structure of the above-mentioned color cathode-ray tube, and has exaggerated the configuration of an electron gun part for explanation. The electron gun held in the neck section consists of the electron beam generating section and the main lens section, accelerates the electron beam generated from the electron beam generating section in the main lens section, converges, and is made the bombardment [ the phosphor screen 3 which becomes the wall of the face plate section 2 which constitutes the glass envelope 1 from the fluorescent substance of three colors by which spreading formation is carried out ] in this drawing.

**[0005]** The electron beam generating section consists of cathode 7, 8, and 9, a 1st grid electrode (G1) 10, and a 2nd grid electrode (G2) 30. The electron beam emitted from cathode 7, 8, and 9 is emitted in the direction of a common flat surface (horizontal direction) along with the medial axes 35, 36, and 37 arranged at \*\*\*\* parallel, and carries out incidence to the main lens section through the 1st grid electrode 10 and the 2nd grid electrode 30.

**[0006]** the 3rd whose main lens section is one main lens electrode -- it consists of grid electrode (G3) 31, a 4th grid electrode (G4) 32, and an electric shielding cup electrode 33. The 3rd grid electrode (G3) The medial axis of the electron beam passage holes 70, 71, 72, 76, 77, and 78 formed in 31 and the electric shielding cup electrode 33 is in agreement with the above-mentioned medial axes 35, 36, and 37, respectively.

**[0007]** Moreover, although the electron beam passage hole 74 of the center of the 4th grid electrode 32 which is the main lens electrode of another side is in agreement with the above-

mentioned medial axis 36, medial axes 35 and 37 are not in agreement, and the medial axes 38 and 39 of the outside electron beam passage holes 73 and 75 are displacing them outside slightly. At the time of actuation, the 3rd grid electrode 31 is set as low voltage rather than the 4th grid electrode 32, and the 4th grid electrode 32 and the electric shielding cup electrode 33 of high potential are connected to the above-mentioned electric conduction film 5 through the electric conduction spring which is not illustrated so that it may become the electric conduction film 5 and this potential which were applied to the inner surface of the funnel section.

[0008] Since the electron beam passage hole of the center section of the 3rd grid electrode 31 and the 4th grid electrode 32 is the same axle, the main lens of axial symmetry is formed in a part for the center section between two electrodes, and the Chuo Electronics beam goes the orbit in alignment with a shaft straight on, after converging with the main lens. On the other hand, since, as for the electron beam passage hole of the outside of two electrodes, the shaft is shifted mutually, outside, the main lens of non-axial symmetry is formed. For this reason, in the divergent lens field formed in the 4th grid electrode 32 side among the main lens fields, an outside electron beam passes the part which separated in the Chuo Electronics beam direction, and receives the concentration to the Chuo Electronics beam direction in a focusing operation and coincidence with the main lens from a lens medial axis.

[0009] Thus, three electron beams are concentrated so that it may lap mutually on a shadow mask 4, at the same time it converges. This intensive operation is called static convergence. An electron beam receives color sorting for which only the part which carries out excitation issuance of the fluorescent substance of the color corresponding to each electron beam by puncturing of a shadow mask 4 passes the above-mentioned puncturing. In addition, a deflecting yoke 6 makes both directions vertical to a horizontal carry out the deflection scan of the phosphor-screen top for an electron beam, and makes a two-dimensional image form on a phosphor screen.

[0010] It is known well that the spherical aberration of the main lens is in the factor which has big effect on the resolution property of the above color cathode-ray tubes. If spherical aberration of the main lens can be made small, the resolution lowering by the diameter buildup of a spot on a phosphor screen can be controlled. Furthermore, in order to reduce the spherical aberration of the main lens, it is known well that amplification of the aperture of the electrode which constitutes the main lens is also effective.

[0011] However, in an inline-type electron gun as shown in drawing 9, since the main lens of the cylindrical shape corresponding to each of three colors of R, G, and B is arranged in the same flat surface, the above-mentioned aperture must be  $1/3$  or less [ of the neck section bore of a glass envelope ]. If the problem on electrode processing is also further considered in consideration of the thickness of an electrode, the upper limit to aperture will turn into a still smaller value. In order to expand this threshold value, expanding a neck section bore brings about the evil in which the deflection power of the deflecting yoke 6 arranged on that outside increases.

[0012] Drawing 10 is an important section sectional view explaining an example of a non-cylindrical shape main lens which can expand the aperture of the main lens more nearly substantially than the above-mentioned threshold value, and it is the front view of the 3rd grid electrode which cut (a) with drawing of longitudinal section, and cut (b) by the A-A line of (a). In this drawing, retreat mutually the electrode plate 41, 421 which constitutes the opposed face of the 3rd grid electrode 41 and the 4th grid electrode 42, arrange, electric field are made to permeate deeply the interior of the 3rd grid electrode 41 and the 4th grid electrode 42, and the same effectiveness as lens aperture amplification is acquired.

[0013] However, not axial symmetry but the horizontal direction (the in-line juxtaposition direction) of the cross section of the electrode periphery section is size perpendicularly. For this reason, osmosis of electric field becomes horizontally and remarkable and the horizontal lens focusing force becomes weak as compared with vertical it. Consequently, generate astigmatism, the cross-section configuration of an electron beam is made to deform for a long time horizontally, and lowering of resolution is brought about.

[0014] In order to amend this, make un-circular the opening configuration of an electron beam

passage hole prepared in the electrode plate 411,421, make the horizontal diameter of opening smaller than the vertical diameter of opening, and he makes strength, a horizontal, and the focusing force of vertical both directions horizontal focusing electric field balance, and is trying to remove astigmatism. In addition, JP,58-103752,A is one of those indicated the above-mentioned electron gun.

[0015] However, in the electrode configuration of the above-mentioned conventional technique, the lens aperture amplification effectiveness cannot fully be efficiently employed from the following reasons. That is, in order to employ the lens aperture amplification effectiveness efficiently, it is necessary to extend the diameter of an electron beam within the main lens but, and if the diameter of an electron beam is expanded more than fixed, a part of electron beam will collide with the electrode plate 411, an electron will flow into the 3rd grid electrode 41, and a current will occur. This current flows into the power circuit which generates the 3rd grid electrode voltage  $V_f$ , i.e., a focal electrical potential difference.

[0016] Since the impedance of a focal power circuit is quite large, it will become impossible for the value of the focal electrical potential difference  $V_f$  which is output voltage to fall, and to operate it on normal focal conditions by the inrush current. Then, although it is possible to consider as the structure which removed the electrode plate 411,421, if this electrode plate 411,421 is removed, since the electrode periphery section cross section is oblong as mentioned above, astigmatism generating will be carried out, and resolution will fall greatly.

[0017] Since this astigmatism is amended, the following means can be considered as an example. That is, the operation which widens an electron beam is only the 3rd grid electrode, and it notes that that a periphery section cross section is oblong in the 4th grid electrode has the operation which makes an electron beam longwise in reverse. If oblong extent of the electrode periphery section of the 3rd grid electrode and the 4th grid electrode, i.e., oblateness, is the same at this time, in the 3rd grid electrode with a low electrical potential difference, the rate of an electron beam is small, from a \*\*\*\*\*, residence time will be strongly influenced of the 3rd grid electrode, it will be synthetically transformed oblong, and astigmatism will generate it as mentioned above.

[0018] Then, what was made into the following electron gun structures is proposed. Drawing 11 is the explanatory view of other examples of the non-cylindrical shape main lens to which the aperture of the main lens is more nearly substantially [ than the above-mentioned threshold value ] expandable, (a) is drawing of longitudinal section and the top view of the 4th grid electrode which saw (b) from the A-A line of (a), and, for the 4th grid electrode and 53, as for the 6th grid electrode and 55, the 5th grid electrode and 54 are [ 51 / the 3rd grid electrode and 52 / an electric shielding cup electrode and 521,522,523 ] slits. In addition, 15 is an electrode bearing bar.

[0019] In this drawing, oblateness is enlarged by the 4th grid electrode 52 side. If oblateness is enlarged with the 4th grid electrode, the lens operation which is going to make the cross section of an electron beam a longwise configuration will become strong, it will become possible to deny each other the lens operation which is going to make an oblong configuration the electron beam in the 3rd grid electrode 51, and astigmatism will be amended.

[0020] However, the fault of the main lens aperture being perpendicular, and it being small, becoming horizontally and large, imbalance arising in aberration, and the configuration of the electronic beam spot being perpendicular on a phosphor screen, and expanding in the example of a configuration of this drawing since the path of the electrode periphery section is perpendicular and small is produced. Then, in this drawing, the imbalance of aberration is amended by considering as the multistage lens which constituted the main lens section from a preceding paragraph main lens and a latter-part main lens, diameter[ of macrostomia ]-izing a latter-part main lens, and considering as the structure made to transform the electron beam which carries out incidence to a latter-part main lens with a preceding paragraph main lens oblong.

[0021] A preceding paragraph main lens is constituted by the 3rd grid electrode 51, the 4th grid electrode 52, and the 5th grid electrode 53, and a latter-part main lens is constituted by the 5th grid electrode 53 and the 6th grid electrode 54. In the example of a configuration of this drawing, the focal electrical potential difference  $V_{fh}$  of about 5-10kV is impressed to the 3rd grid

electrode 51 and the 5th grid electrode 53, and the low battery of about 500-1kV is impressed to the 4th grid electrode 52. And slits 5211, 5221, and 5231 are horizontally formed to the electron beam passage hole 521,522,523 of the 4th grid electrode 52, and the cross-section configuration of an electron beam deforms oblong with a preceding paragraph main lens with an electron beam passage hole with this slit configuration.

[0022] However, in case an electron beam is made to transform oblong with a preceding paragraph main lens, when extent of this deformation is large, an electron beam will converge perpendicularly and very strongly. since a focusing operation of this perpendicular direction will become still stronger if a focal electrical potential difference is increased -- a perpendicular direction -- if -- the distance from the main lens to a converging point becomes short, and the conditions on which an electron beam is converged on a phosphor screen stop existing

[0023] When a focal electrical potential difference is reduced, the reinforcement of a latter-part main lens becomes strong, as for perpendicularity and level both directions, the distance from the main lens to a converging point becomes short, and the conditions on which both directions converge an electron beam on a phosphor screen stop on the other hand, existing. When deformation of the cross-section configuration of an electron beam with a preceding paragraph means lens is large, the conditions on which an electron beam is converged on a phosphor screen may stop existing perpendicularly, from the above thing, whether it increases a focal electrical potential difference or makes it fall.

[0024] What is necessary is just to consider as a preceding paragraph main lens configuration which a lens operation of a preceding paragraph main lens becomes weaker, and lessens cross-section configuration deformation of an electron beam, when increasing a focal electrical potential difference in order to solve this. At this time, lifting of the focal electrical potential difference impressed to one electrode of a latter-part main lens also about a latter-part main lens brings about reduction of an electrical-potential-difference difference with the high tension of the electrode of another side. For this reason, the lens reinforcement of a latter-part main lens is also reduced.

[0025] Therefore, if perpendicular [ a focal electrical potential difference is increased and ], in a preceding paragraph lens and a latter-part lens, a focusing operation will become strong, and the distance from the main lens to the point converging [ electron beam ] will become short. In this way, if a focal electrical potential difference is made the optimal, even when it is perpendicular, the conditions on which an electron beam can be converged on a phosphor screen will exist.

[0026]

[Problem(s) to be Solved by the Invention] However, there are the following troubles resulting from the electrode structure of the electron gun in the color cathode-ray tube which \*\* equipped with the above-mentioned conventional electron gun. Since the low-battery lateral electrode of said main lens section is diameter[ of macrostomia ]-ized to the maximum extent, and an electrode bearing bar is divided by 2 sets, the cathode-rays side bearing bar 15 and fluorescent substance side bearing-bar 15', with the main lens, it becomes complicated like an erector and an assembly error also becomes large. That is, there is a problem that \*\*\*\*\* will get worse.

[0027] The object of this invention is to offer the cathode-ray tube possessing the electron gun which raised the focal property while simplifying electron gun structure, without reducing the lens electrode aperture of the main lens section.

[0028]

[Means for Solving the Problem] In order to attain the above-mentioned object, this invention holds down the aperture of the perpendicular direction of the low-battery lateral electrode of the main lens concerned to 1 set of below spacing of an electrode bearing bar so that the main lens section may not divide an electrode bearing bar, and is characterized by considering as the lens structure of the opposite form where fixed spacing was prepared between the above-mentioned high-tension lateral electrodes.

[0029] Namely, the electron beam generating section which this invention is arranged on a common flat surface, and generates two or more controlled electron beams. In the cathode-ray tube equipped with the main lens section which completes two or more electron beams



generated from said electron beam generating section on a phosphor screen at least. The electrode of a couple is included at least. said main lens section counters the travelling direction of an electron beam with fixed spacing mutually, and a cross section is flat in a direction parallel to said common flat surface -- at the time of actuation of a cathode-ray tube Impress a low battery to one side of the electrode of said couple, and it comes to impress high tension by another side. It has the flattening electrode means which consists of at least one electrode with which said main lens section fabricates flatly the cross-section configuration of said electron beam which carries out incidence to the electrode of said couple in said direction of a common flat surface. It comes to impress said low battery by at least one electrode which constitutes said flattening electrode means, and the operation which fabricates the cross-section configuration of said electron beam flatly is characterized by providing the electron gun constituted so that it might decrease with lifting of said low battery with said flattening electrode means.

[0030] Furthermore, the electron beam generating section which this invention is arranged on a common flat surface, and generates two or more controlled electron beams, In the cathode-ray tube equipped with the main lens section which completes two or more electron beams generated from said electron beam generating section on a phosphor screen at least. The electrode of a couple is included at least. said main lens section counters the travelling direction of an electron beam with fixed spacing mutually, and a cross section is flat in a direction parallel to said common flat surface -- at the time of actuation of a cathode-ray tube The flat degree of the cross section of the electrode of said another side which impresses a low battery to one side of the electrode of said couple, and impresses high tension to another side, and impresses said high tension comes to constitute more greatly than whenever [ of the cross section of one / said / electrode / flat ]. It has the flattening electrode means which consists of at least one electrode with which said main lens section fabricates flatly the cross-section configuration of said electron beam which carries out incidence to the electrode of said couple in said direction of a common flat surface. It comes to impress said low battery by at least one electrode which constitutes said flattening electrode means, and the operation which fabricates the cross-section configuration of said electron beam flatly is characterized by providing the electron gun constituted so that it might decrease with lifting of said low battery with said flattening electrode means.

[0031] Moreover, this invention is set to the cathode-ray tube equipped with the electron beam generating section which generates the controlled single electron beam, and the main lens section which completes the electron beam generated from said electron beam generating section on a phosphor screen at least. The electrode of a couple is included at least. said main lens section counters the travelling direction of an electron beam with fixed spacing mutually, and a cross section is flat in one direction -- at the time of actuation of a cathode-ray tube Impress a low battery to one side of the electrode of said couple, and it comes to impress high tension by another side. It has the flattening electrode means which consists of at least one electrode with which said main lens section fabricates flatly the cross-section configuration of said electron beam which carries out incidence to the electrode of said couple in said one direction. The cathode-ray tube to which it comes to impress said low battery by at least one electrode which constitutes said flattening electrode means, and the operation which fabricates the cross-section configuration of said electron beam flatly is characterized by providing the electron gun constituted so that it might decrease with lifting of said low battery with said flattening electrode means.

[0032] In the cathode-ray tube equipped with the electron beam generating section which generates the controlled single electron beam further again, and the main lens section which completes the electron beam generated from said electron beam generating section on a phosphor screen at least. The electrode of a couple is included at least. said main lens section counters the travelling direction of an electron beam with fixed spacing mutually, and a cross-section configuration is flat in one direction -- at the time of actuation of a cathode-ray tube The flat degree of the cross section of the electrode of said another side which impresses a low battery to one side of the electrode of said couple, and impresses high tension to another side,

and impresses said high tension comes to constitute more greatly than whenever [ of the cross section of one / said / electrode / flat ]. It has the flattening electrode means which consists of at least one electrode with which said main lens section fabricates flatly the cross-section configuration of said electron beam which carries out incidence to the electrode of said couple in said one direction. It comes to impress said low battery by at least one electrode which constitutes said flattening electrode means, and the operation which fabricates the cross-section configuration of said electron beam flatly is characterized by providing the electron gun constituted so that it might decrease with lifting of said low battery with said flattening electrode means.

[0033]

[Function] By considering as the opposite form which described above the electrode structure of the main lens section, with this kind of electron gun, the electrode bearing bar whose 2 sets were becomes 1 set, and can be simplified like the erector of an electron gun. Although the upper limit of the path of the perpendicular direction of the low-battery lateral electrode which constitutes the main lens section is reduced to 1 set of below spacing of an electrode bearing bar according to this structure, since diameter-ization of macrostomia of the high-tension lateral electrode which was not able to be opened on problems, such as withstand voltage, can be attained, the main lens of the diameter of macrostomia can be obtained with the conventional technique.

[0034] Moreover, the imbalance of the spherical aberration of horizontal [ by the configuration of the electrode which constitutes the main lens section being horizontally flat ], and a perpendicular direction is carrying out incidence of the oblong electron beam by said flattening electrode means to a latter-part main lens, and astigmatism is amended by the ratio of the oblateness of the main lens electrode which counters.

[0035]

[Example] Hereafter, with reference to a drawing, it explains to a detail about the example of this invention. The explanatory view of the electron gun which possesses drawing 1 in the one example of the cathode-ray tube by this invention, the important section side elevation where drawing 2 looked at the electron gun of drawing 1 from the electrode bearing-bar side, the front view of the 4th grid electrode which saw drawing 3 from A-A of drawing 1, and drawing 4 are the important section sectional views which disconnected the 5th grid electrode by the B-B line of drawing 1.

[0036] For the 4th grid electrode and 13, as for the 6th grid electrode and 15, in each drawing, the 5th grid electrode and 14 are [ 11 / the 3rd grid electrode and 12 / an electrode bearing bar and 16 ] neck section glass tubes. In drawing 1 and drawing 2, the preceding paragraph lens section consists of a 3rd grid electrode 11, a 4th grid electrode 12, and a 5th grid electrode 13, and the latter-part lens section consists of a 5th grid electrode 13 and a 6th grid electrode 14.

[0037] In this drawing, the focal electrical potential difference of 5-10kV is impressed to the 3rd grid electrode 11 and the 5th grid electrode 13, and the 6th grid electrode 14 and the common high tension of 20-35kV are un-impressed to the 4th grid electrode 12. As shown in drawing 3, the vertical slits 1211, 1221, and 1231 are formed in the electron beam passage hole 121,122,123 of the 4th grid electrode 12, respectively. These slits 1211, 1221, and 1231 are deformed by the cross-section configuration of an electron beam oblong with a preceding paragraph main lens.

[0038] As the 5th grid electrode 13 and the 6th grid electrode 14 were shown in drawing 4, each of that cross section is flat horizontally, but since this oblateness is enlarged with the 6th grid electrode 14, astigmatism is amended. Moreover, since the cross-section configuration of the electron beam which carries out incidence to a latter-part main lens deforms oblong, the imbalance of the spherical aberration produced according to a latter-part main lens being flat is amended, and the circular electronic beam spot can be obtained on a phosphor screen.

[0039] Furthermore, by having the structure where the lens reinforcement of a preceding paragraph main lens falls with buildup of a focal electrical potential difference, it will be perpendicular, a focusing operation will always be too strong, and the problem of the conditions on which an electron beam is converged in a phosphor screen stopping existing is not generated, either. It is as follows when an example which asked for the electrode dimension of the electron



gun of the above-mentioned example by three-dimension electron beam simulation is shown.

[0040]

perpendicular direction height  $V4=5.0\text{mm}$  of the diameter of perpendicular direction  $V6=10.2\text{mm}$  4th grid electrode of the diameter of perpendicular direction  $V5=13.0\text{mm}$  6th grid electrode of the diameter [ of horizontal ]  $H6=22\text{mm}$  5th grid electrode of the diameter [ of horizontal ]  $H5=20\text{mm}$  6th grid electrode of the 5th grid electrode -- the 3rd and the 4th -- With the body-diameter  $\phi G4=4.0\text{mm}$  above-mentioned electrode dimension of the 5th grid electrode, the oblateness (the diameter of vertical / diameter of level) of the diameter of the electronic beam spot by the spherical aberration on a phosphor screen is about 1.2, and approaches circularly. Moreover, the diameter of a spot by the spherical aberration at this time (a horizontal, vertical pitch diameter) is also reduced 28% as compared with the diameter of a spot when setting a latter-part main lens to  $\phi 15\text{mm}$ , and according to this example, aberration is substantially improved by diameter-ization of macrostomia of an effectual lens.

[0041] The explanatory view of the electron gun which possesses drawing 5 in other examples of the cathode-ray tube by this invention, the important section side elevation where drawing 6 looked at the electron gun of drawing 5 from the electrode bearing-bar side, the front view of the 3rd grid electrode which saw drawing 7 from A-A of drawing 5, and drawing 8 are the important section sectional views which disconnected the 4th grid electrode by the B-B line of drawing 5. For the 3rd grid electrode and 22, as for the 5th grid electrode and 15, in drawing 5 and drawing 6, the 4th grid electrode and 23 are [ 21 / an electrode bearing bar and 16 ] neck section glass tubes.

[0042] A preceding paragraph main lens is constituted from a 3rd grid electrode 21 and a 4th grid electrode 22, and a latter-part main lens is constituted from this example by the 4th grid electrode 22 and the 5th grid electrode 23. In this example, the 5th grid electrode 23 and the common high tension of about 20-35kV are impressed to the 3rd grid electrode 21, and the focal electrical potential difference of about 5-10kV is impressed to the 4th grid electrode 22.

[0043] As shown in drawing 7, the vertical slits 211, 212, and 213 are formed in the electron beam passage hole 211, 212, 213 of the 3rd grid electrode 21, respectively, and this slit is deformed into it by the cross-section configuration of an electron beam oblong with a preceding paragraph main lens. As shown in drawing 8, as for the oblateness of the 4th grid electrode 22 and the 5th grid electrode 23, the 5th grid electrode 23 is enlarged.

[0044] Since the electron gun by this example also has the structure where preceding paragraph main lens reinforcement falls with buildup of a focal electrical potential difference, when it is perpendicular and a focusing operation is always too strong, the problem of the conditions on which an electron beam is converged in a phosphor screen stopping existing is not produced. In addition, although each example explained above was explained as an electron gun applied to a color cathode-ray tube with three electron beams, it cannot be overemphasized that it is what does not restrict this invention to this and can be applied also to the monochromatic cathode-ray tube using a single electron beam.

[0045] as that in which the example which applied this invention to the cathode-ray tube of this \*\*\*\* has the electron beam passage hole which lets one electron beam pass for each electrode structure in the above-mentioned color cathode-ray tube -- reading \*\*\*\* -- since things are made, especially a drawing is shown and is not explained.

[0046]

[Effect of the Invention] Holding the engine performance equivalent to the complicated diameter electron gun of macrostomia of structure according to this invention, as explained above By simplifying structure, the cathode-ray tube which improved resolution substantially and realized it by low cost can be offered using the electron gun which can raise mass production nature substantially by fully employing the effectiveness of diameter[ of macrostomia ]-izing of the main lens section of this electron gun efficiently.

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**DESCRIPTION OF DRAWINGS**

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**[Brief Description of the Drawings]**

**[Drawing 1]** It is the explanatory view of the electron gun provided in the one example of the cathode-ray tube by this invention.

**[Drawing 2]** It is the important section side elevation which looked at the electron gun of drawing 1 from the electrode bearing-bar side.

**[Drawing 3]** It is the front view of the 4th grid electrode seen from A-A of drawing 1.

**[Drawing 4]** It is the important section sectional view which disconnected the 5th grid electrode by the B-B line of drawing 1.

**[Drawing 5]** It is the explanatory view of the electron gun provided in other examples of the cathode-ray tube by this invention.

**[Drawing 6]** It is the important section side elevation which looked at the electron gun of drawing 5 from the electrode bearing-bar side.

**[Drawing 7]** It is the front view of the 3rd grid electrode seen from A-A of drawing 5.

**[Drawing 8]** It is the important section sectional view which disconnected the 4th grid electrode by the B-B line of drawing 5.

**[Drawing 9]** It is a cross section explaining the structure of a color cathode-ray tube.

**[Drawing 10]** It is an important section sectional view explaining an example of a non-cylindrical shape main lens which can expand the aperture of the main lens more nearly substantially than the above-mentioned threshold value, and is the front view of the 3rd grid electrode which cut (a) with drawing of longitudinal section, and cut (b) by the A-A line of (a).

**[Drawing 11]** It is the explanatory view of other examples of the non-cylindrical shape main lens to which the aperture of the main lens is more nearly substantially [ than the above-mentioned threshold value ] expandable, and (a) is drawing of longitudinal section and the top view of the 4th grid electrode which saw (b) from the A-A line of (a).

**[Description of Notations]**

1 Vacuum Envelope

2 Face Plate

3 Fluorescent Substance

4 Shadow Mask

5 Electric Conduction Film

6 Deflecting Yoke

7, 8, 9 Cathode

10 1st Grid Electrode (G1)

30 2nd Grid Electrode (G2)

11, 21, 31 The 3rd grid electrode

12, 22, 32 The 4th grid electrode

13 23 The 5th grid electrode

14 6th Grid Electrode

15 Electrode Bearing Bar

16 Neck section glass tube.

2004年 8月11日 13時52分

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[Translation done.]

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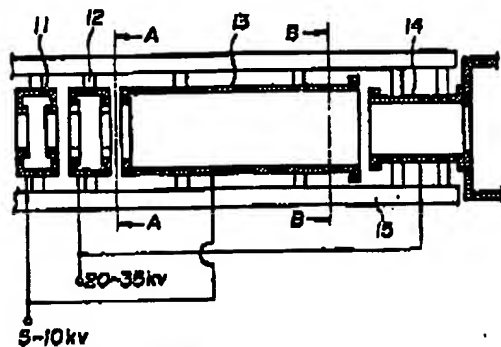
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## DRAWINGS

[Drawing 1]

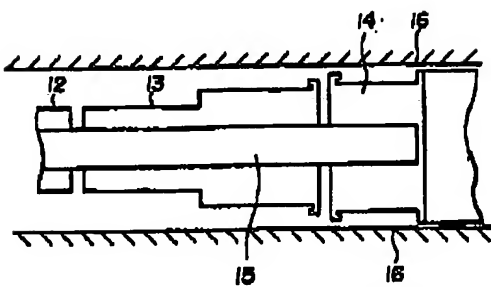
図 1



- 11: G 3 電極
- 12: G 4 電極
- 13: G 5 電極
- 14: G 6 電極
- 15: 電極支持棒

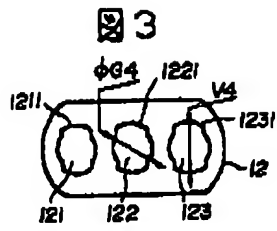
[Drawing 2]

図 2



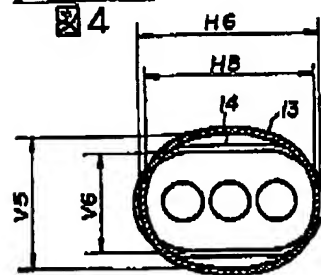
- 16: ネックガラス内壁

[Drawing 3]



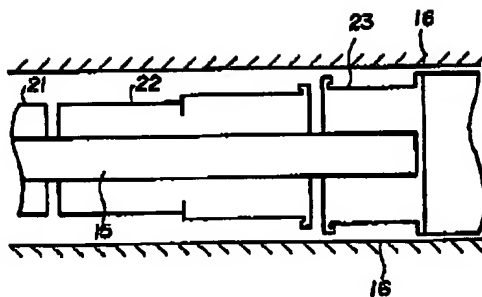
121, 122, 123: スリット

[Drawing 4]



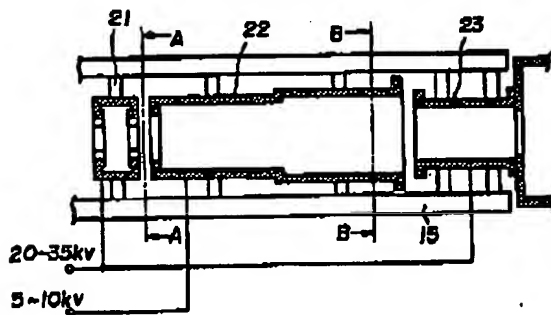
[Drawing 6]

図 6



[Drawing 5]

図 5

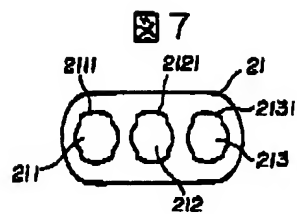


21: G 3 電極  
22: G 4 電極  
23: G 5 電極

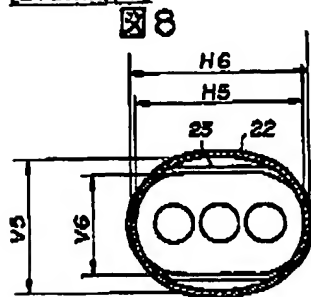
[Drawing 7]

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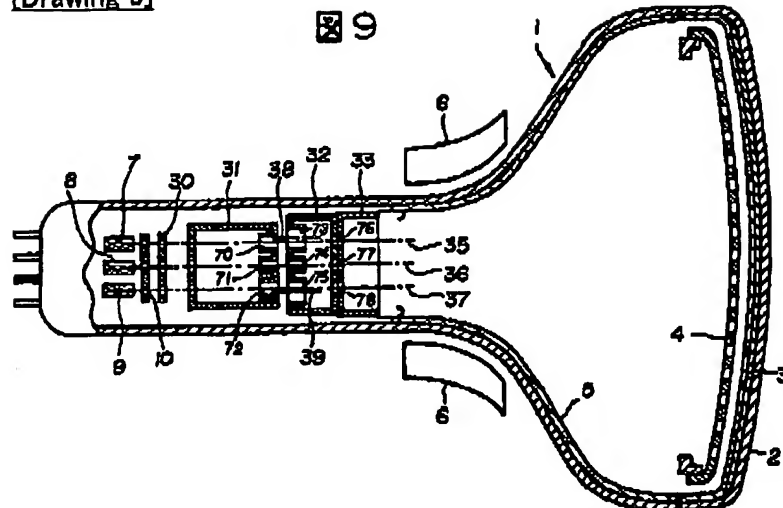
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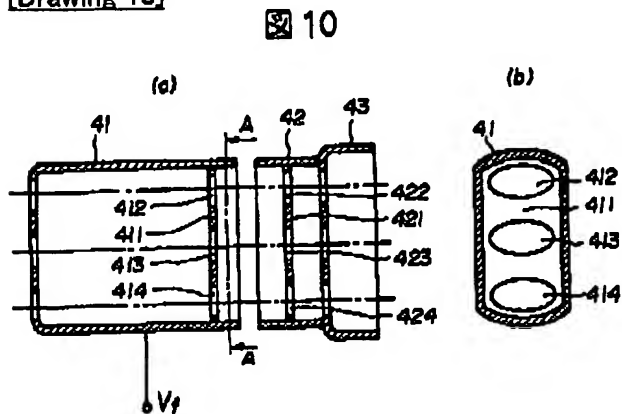
[Drawing 8]



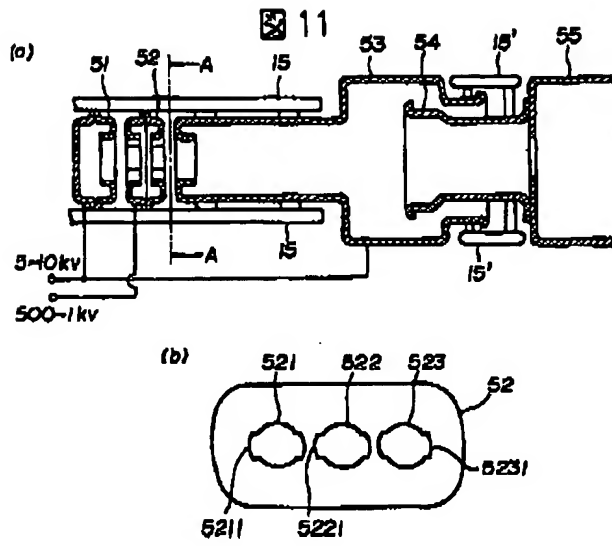
[Drawing 9]



[Drawing 10]



[Drawing 11]



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[Translation done.]